

# MOORED DATA BUOY OBSERVATION CODE AND C-MAN OBSERVATIONS

## I. AUTOMATIC DATA BUOY OBSERVATION CODE FORMAT

Observations from moored buoys are transmitted in a slightly modified form of the FM-13 SHIP code. C-MAN Observations are transmitted in a modified form of the FM-12 SYNOP code. Observations from drifting buoys are transmitted in the FM-18 BUOY code. Reports of spectral wave information from a ship, buoy, aircraft or satellite platform are transmitted in the FM-65 WAVEOB format. Neither the FM-18 BUOY code or the FM-65 WAVEOB code is presented here.

### A. SYMBOLIC FORM OF THE FM-13-SHIP CODE FOR MOORED BUOYS

$M_i M_j M_k M_l$   
 $A_1 b_w n_b n_b n_b$  YYGGi<sub>w</sub> 99L<sub>a</sub>L<sub>a</sub>L<sub>a</sub> Q<sub>c</sub>L<sub>o</sub>L<sub>o</sub>L<sub>o</sub>L<sub>o</sub> iRiX/// /ddff 1s<sub>n</sub>TTT 2s<sub>n</sub>T<sub>d</sub>T<sub>d</sub>T<sub>d</sub>  
 (3PoPoPoPo) 4PPPP 5appp 9GGgg 22200 0s<sub>n</sub>T<sub>w</sub>T<sub>w</sub>T<sub>w</sub> 1P<sub>wa</sub>P<sub>wa</sub>H<sub>wa</sub>H<sub>wa</sub>  
 70H<sub>wa</sub>H<sub>wa</sub>H<sub>wa</sub> 333 912ff 555 11fff 22fff 3GGgg 4ddf<sub>m</sub>f<sub>m</sub> 6GGgg dddfff dddfff  
 dddfff dddfff dddfff dddfff.

If no data is available for an entire group, then that group may be omitted from the report.

#### Example of a Moored Buoy message.

```
SMVD15 KWBC 061200
BBXX
42002 06121 99259 70936 46/// /2403 10257 20226 40117 53014 91149
22200 00289 10401 70004 333 91207 555 11032 22033 31123 42211 61139
228071 224096 226088 227076 216068 203056=
```

#### Definition of Groups

##### 1. Buoy identifier, time, and location groups.

$M_i M_j M_k M_l$  - Bulletin Identifier

The first group in the section ( $M_i M_i M_j M_j$ ) is not transmitted from the buoy, but is added on to a group of reports before they are transmitted in a bulletin. In any bulletin of reports from ocean stations,  $M_i M_i M_j M_j$  is always encoded as BBXX. The group BBXX is then transmitted only once in the bulletin, as the first line of the bulletin. The only thing that BBXX does is to identify the bulletin as a group of reports from ocean stations.

**$A_1 b_w n_b n_b n_b$  - Buoy Identifier**

$A_1$  - *WMO Region in which the buoy is located.* The U.S. operates stations in both WMO Region IV and Region V. A U.S. buoy located in WMO Region IV would have an identifier beginning with number 4. A U.S. buoy located in WMO region V would have an identifier beginning with 5. See appendix C for WMO Region charts.

$b_w$  - *Sub-area within the WMO Region.* Figure 1 shows the sub-areas within the WMO areas. Each of them is identified by the two-digit number given by. The identifiers for buoys within the WMO Regions IV and V are as follows:

- ↓  $A_1 b_w = 41$ : North Atlantic from about Cape Hatteras south.
- ↓  $A_1 b_w = 42$ : Gulf of Mexico
- ↓  $A_1 b_w = 44$ : North Atlantic from about Cape Hatteras north
- ↓  $A_1 b_w = 45$ : Great Lakes
- ↓  $A_1 b_w = 46$ : Off the west coast of the U.S. and the Gulf of Alaska
- ↓  $A_1 b_w = 51$ : Pacific Ocean, in and near the Hawaiian Islands.

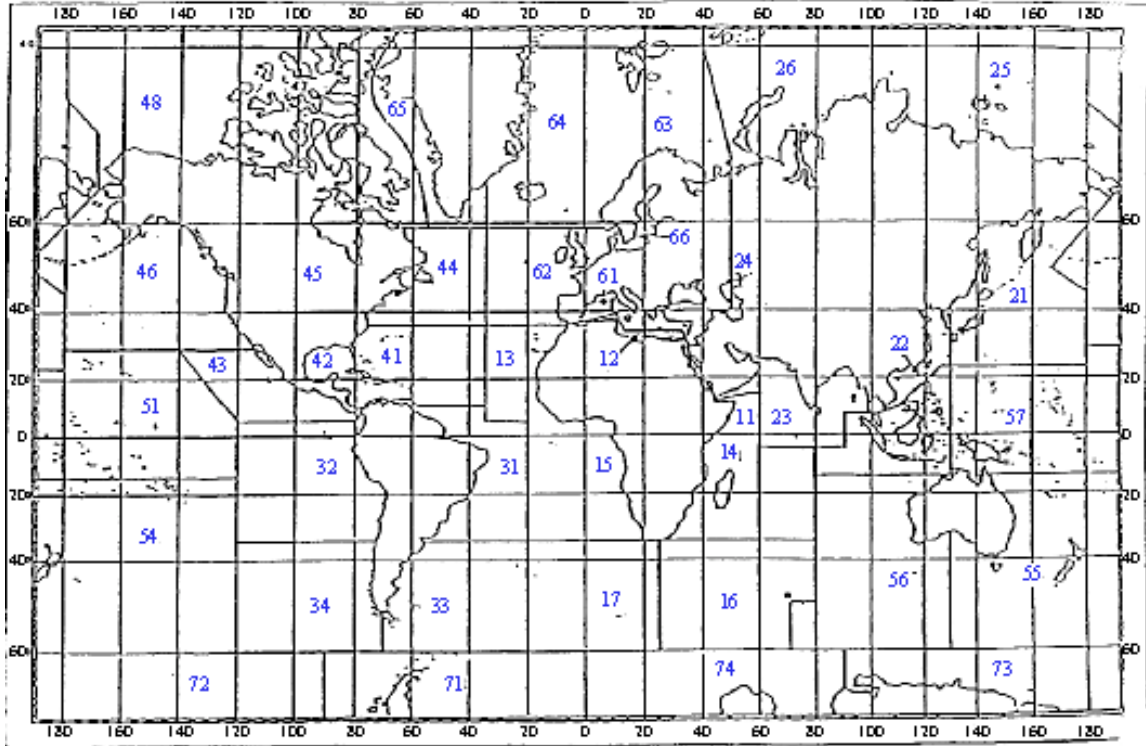


Figure 1. Buoy Identifiers and locations.

- $n_b n_b n_b$  - *Serial number of the buoy site within the sub-area. If a buoy fails and is replaced, the new buoy will take the old number. The group 42002 indicates this is buoy 002 in WMO region 4, sub area 2.*
- YYGGi<sub>w</sub>** - **Date-Time Group and units of wind speed**
- YY - *Day of the month of the observation in UTC.*
- GG - *Time of the observation to the nearest whole hour UTC.*
- i<sub>w</sub> - *Wind speed indicator. See code table 1855 of the land surface synoptic code. The group 06121 indicates the observation is for the 6th day of the month at 1200 UTC and that wind speed is given in meters per second.*
- 99L<sub>a</sub>L<sub>a</sub>L<sub>a</sub>** - **Buoy Latitude Group**
- 99 - *Identifier for Buoy Latitude group.*
- L<sub>a</sub>L<sub>a</sub>L<sub>a</sub> - *Latitude, in tenths of degrees, of the buoy. The group 99259 indicates a latitude of 25.9°. The 7 of the next group, indicates the latitude is North.*

- Q<sub>c</sub>L<sub>0</sub>L<sub>0</sub>L<sub>0</sub>L<sub>0</sub>** - **Buoy Longitude Group**
- Q<sub>c</sub> - *Quadrant of the globe* the buoy is located in. See code table 3333 of the Ship Synoptic Code, appendix D.
- L<sub>0</sub>L<sub>0</sub>L<sub>0</sub>L<sub>0</sub> - *Longitude of the buoy* in tenths of degrees. The group 70936 indicates the longitude is 93.6°W.

## 2. Meteorological Data

### **iRiX/// /ddff 1s<sub>n</sub>TTT 4PPPP 5appp**

- iRiX///** - **Inclusion or exclusion of precipitation data and indicator for whether the station is staffed or automatic.**
- iR - *Precipitation group indicator.* This character will always be encoded as 4 since no precipitation is included in the report.
- iX - *Type of station indicator.* This character will always be encoded as 6 since the buoy is an automatic station.

This entire group, in a buoy report, is always encoded as 46///.

- /ddff** - **Surface Wind Direction and Speed Group.**
- / - *Cloud amount.* This character is used in other reports to encode cloud amount data that is not available from a data buoy, so the character is always encoded as /.
- dd - *The true wind direction* from which the wind is blowing, reported to the nearest tens of degrees. This is a vector average over the time period from 20 minutes before the hour to ten minutes before the hour. See code table 0877 of the land station surface synoptic code.
- ff - *The wind speed in meters per second.* The wind speed is always encoded as a two-digit number. When the wind speed, in units indicated by i<sub>w</sub>, is 99 units or more, ff shall be encoded 99, and the group 00ff shall be included immediately following the group /ddff. The group /2403 indicates an average 10-minute wind direction of 240° and a speed of 3 mps.

- 1s<sub>n</sub>TTT** - **Air Temperature Group.**
- 1 - *Identifier for the air temperature group.*
  - s<sub>n</sub> - Sign of the air temperature; 0 = positive or zero; 1 = negative.
  - TTT - Air temperature reported in tenths of degrees Celsius. The group 10257 indicates an air temperature of 25.7°C.
- 2s<sub>n</sub>T<sub>d</sub>T<sub>d</sub>T<sub>d</sub>** - **Dew Point Group.**
- 2 - Identifier for the dew point group.
  - s<sub>n</sub> - Sign of the dew point.
  - T<sub>d</sub>T<sub>d</sub>T<sub>d</sub> - Dew point reported in tenths of degrees Celsius. The group 20226 indicates a dew point of 22.6°C.
- (3P<sub>o</sub>P<sub>o</sub>P<sub>o</sub>P<sub>o</sub>)** - **Station Pressure Group.** Some buoys may report this group even though they also report the Sea-level Pressure group.
- 3 - *Identifier for the station pressure group.*
  - P<sub>o</sub>P<sub>o</sub>P<sub>o</sub>P<sub>o</sub> - *Station pressure* reported in tenths of hectopascals. If the pressure is higher than 1000.0 hPa, the thousands unit is dropped.
- 4PPPP** - **Sea-Level Pressure Group**
- 4 - *Identifier for the sea-level pressure group.*
  - PPPP - *Sea-level pressure* reported in tenths of hectopascals. If the pressure is higher than 1000.0 hPa, the thousands unit is dropped. The group 40117 indicates a sea level pressure of 1011.7 hPa.

- 5appp** - **3-Hour Pressure Change Group.**
- 5 - *Identifier for the 3-hour pressure change group.*
- a - *Sign and character of the pressure tendency. Some buoys contain algorithms for selecting the appropriate pressure tendency code figure in accordance with code table 0200 found in appendix C. Some older buoys have the ability to determine only three code figures for a, as shown below:*
- a = 2 Observed pressure is higher than 3 hours ago.
- a = 4 Observed pressure is the same as 3 hours ago.
- a = 7 Observed pressure is lower than 3 hours ago.
- ppp - *Amount of pressure change during the past 3 hours encoded to the nearest tenths of millibars. The group 53014 indicates the pressure decreased then increased and it is higher by 1.4 hPa than it was 3 hours ago.*
- 9GGgg** - **End of Data acquisition Time.**
- 9 - *Identifier for the end of data acquisition time group.*
- GGgg - *Time of end of data acquisition in hours and minutes UTC. The group 91149 means that only data prior to 1149Z was used for the current observation.*

### 3. Marine Data

**22200**  $0s_n T_w T_w T_w$   $1P_{wa} P_{wa} H_{wa} H_{wa}$   $70H_{wa} H_{wa} H_{wa}$

- 22200** - **Identifier for the Marine Data Section.**
- $0s_n T_w T_w T_w$  - **Sea Surface Temperature Group**
- 0 - *Identifier for the sea-surface temperature group.*
- $s_n$  - *Sign of the sea-surface temperature; 0 = positive or zero, 1 = negative.*
- $T_w T_w T_w$  - *Sea-surface temperature encoded to the nearest tenths of a degree Celsius. The group 00289 indicates a sea-surface temperature of 28.9°C.*

### **1P<sub>wa</sub>P<sub>wa</sub>H<sub>wa</sub>H<sub>wa</sub> - Wave Group**

1 - *Identifier for the primary wave group.* This identifies the group as reporting instrumental wave data (i.e. wave period and heights measured by an instrument). The group 2P<sub>w</sub>P<sub>w</sub>H<sub>w</sub>H<sub>w</sub>, as found in the ship reports and coastal station reports, is used to report waves that have been observed by a person.

P<sub>wa</sub>P<sub>wa</sub> - *Period of the waves* in whole seconds.

H<sub>wa</sub>H<sub>wa</sub> - *Height of the waves* in half meters. See the table in the land station synoptic code for the code figure for the heights. If the wave height can't be measured, i.e. because the sea is confused, then encode the height as //. The group 10401 indicates a period of 4 seconds and a height of one half-meter.

**70H<sub>wa</sub>H<sub>wa</sub>H<sub>wa</sub> - High resolution wave group.** This group is reported only if group 1P<sub>wa</sub>P<sub>wa</sub>H<sub>wa</sub>H<sub>wa</sub> is reported.

70 - *Indicator for the high resolution wave group.*

H<sub>wa</sub>H<sub>wa</sub>H<sub>wa</sub> - *The wave height in tenths of meters*, as measured instrumentally. The group 70004 indicates a wave height of 00.4 meters.

### **4. Regional Data**

Section 3 is used to report regional data. In the data buoy report, the only regional data included are the maximum wind speed.

#### **333 912ff**

**333** - **Identifier for section 3 of the report.**

**912ff** - **Special Phenomena Group to Report 5-second Peak Wind.**

912 - *Identifier for 5-second peak wind group.*

ff - *The highest peak wind speed measured during a 4- to 8-second period* (depending on the particular buoy) during the 8 minute observation period used to find the average wind. This is a "spot" wind, while the wind in the /dfff group in section 1 is a vector average. The maximum wind speed is reported in meters per second. If the wind is calm, 00 will be encoded. 91207 indicates a peak wind of 7 meters per second.

- 555**
- **Indicator that national code groups follow.**
- 11fff 22fff**
- **Equivalent wind speed data groups.** The height of the anemometer on a U.S. data buoy may vary from 3.4 meters to 13.8 meters. The WMO standard anemometer height is 10 meters. The average height for a ship anemometer, and the height used for most oceanographic wave models, is 20 meters. In the group 11fff, the letters fff represent the equivalent wind speed at 10 meters, in tenths of a meter per second, and in the group 22fff, the letters fff represent the equivalent wind speed at 20 meters. Both groups are included regardless of the anemometer height. The groups 11032 22033 indicate a 10-meter wind speed of 3.2 mps. and a 20-meter wind speed of 3.3 mps.
- 3GGgg**
- **Time at which the peak wind speed since the time of the last observation** occurred. The group means the peak wind speed (since the last observation) occurred at 1123 UTC.
- GG
- *Time in hours.*
- gg
- *Time in minutes.*
- 4ddf<sub>m</sub>fm**
- **Direction and speed of peak wind speed since the last observation group.** The group 42211 indicates the peak wind was from 220° at 11 meters per second.
- dd
- *True direction in tens of degrees of the maximum wind speed since the last observation*
- f<sub>m</sub>fm
- *Maximum wind speed, in meters per second, since the time of the last observation.*
- 6GGgg**
- **End time in hours and minutes of the latest 10-minute continuous wind measurements.** The group 61139 means 10-minute continuous wind measurements were stopped at 1139 UTC.
- GG
- Time in hours.
- gg-
- Time in minutes
- dddfff**
- **Average wind speed and direction of the last 10-minutes of continuous wind measurements.** The group 228071 indicates a direction of 228° and a wind speed of 7.1 meters per second.

- dddfff** - **Average wind speed and direction of the next older 10-minutes of continuous wind measurements.** The group 224096 indicates a direction of 224<sup>o</sup> and a speed of 9.6 meters per second.
- dddfff** - **Average wind speed and direction of the third oldest 10-minutes of continuous wind measurements.** This group is 226088.
- dddfff** - **Average wind speed and direction of the fourth oldest 10-minutes of continuous wind measurements.** This group is 227076.
- dddfff** - **Average wind speed and direction of the fifth oldest 10-minutes of continuous wind measurements.** This group is 216068.
- dddfff** - **Average wind speed and direction of the sixth oldest 10-minutes of continuous wind measurements.** This group is 203056.

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## B. SYMBOLIC FORM OF THE FM-12 SYNOP CODE FOR C-MAN STATION OBSERVATIONS

CMAN YYGGi<sub>w</sub>

DDDD iRiX/// /ddff 1s<sub>n</sub>TTT 2s<sub>n</sub>TdTdT<sub>d</sub> 4PPPP 5appp 9GGgg 222// 0s<sub>n</sub>TwTwTw  
1P<sub>w</sub>P<sub>w</sub>P<sub>w</sub>P<sub>w</sub> 70H<sub>wa</sub>H<sub>wa</sub>H<sub>wa</sub>H<sub>wa</sub> 333 912ff 555 110ff 220ff 3GGgg 4dddff 6GGmm  
dddff dddff dddff dddff dddff dddff (TIDE1hhh)=.

### Example of a C-MAN observation.

SXUS20 KWBC 061200  
CMAN 06124  
TPLM2 46/// /0827 10249 40116 56017 91200 222// 00254 333 91231  
555 11026 22028 31144 415041 61159 082027 082026 082026 083025 082025 082025  
TIDE1157=

### Definitions of groups

#### 1. C-MAN station identification and time.

- CMAN** - **CMAN** identifies the messages in the SXUS20 bulletin as being from coastal marine stations.
- YYGGi<sub>w</sub>** - **Date-Time and units of wind speed.** The group 06124 indicates the 6th day of the month, 1200Z as the observation time and 4 indicates the wind speed is measured and reported in knots
- DDDD** - **C-MAN station identifier.** TPLM2 indicates the report was transmitted from Thomas Point, Maryland. It is not necessary to transmit the latitude and longitude since these stations are located on land at coastal sites; such as, light houses, islands, reefs, atolls, etc. for which the latitude and longitude is known.

#### 2. Meteorological data

- iRiX///** - **Inclusion or exclusion of precipitation data.** For the group 46///, 4 indicates no precipitation is included in the report and 6 indicates the station is an automatic station.
- /ddff** - **Surface Wind Direction and Speed.** The group /0827 indicates a wind direction of 080° and a speed of 27 knots.

- 1snTTT** - **Air Temperature Group.** The group 10249 indicates an air temperature of 24.9°C.
- 2snTdTdTd** - **Dew Point Group.** This group is not included in the example message. Either the site is not equipped for dew point measurement or the sensor is inoperable.
- 4PPPP** - **Sea-Level Pressure Group.** The group 40116 indicates a sea level pressure of 1011.6 hPa.
- 5appp** - **3-Hour Pressure Change Group.** The group 9GGgg 56017 indicates the pressure decreased then was steady and the pressure is 1.7 hPa lower at the time of the observation than it was three hours ago.
- 9GGgg** - **Valid time of observation.** The group 91200 indicates the observation is valid for 1200 UTC. This is a redundant reporting of the time in the YYggiw group.

### 3. Marine Data

**222// 00254**

- 222//** - **Identifier for the Marine Data Section.**
- 0snTwTwTw** - **Sea Water Temperature Group.** The group 00254 indicates a sea water temperature of 25.4°C.

### 4. Regional Data

**333 912ff**

- 333** - **Identifier for the Regional Data Section.**
- 91231** - **5-second Peak Wind Group.** The group 91231 indicates a 5-second peak wind of 31 knots.

### 5. National Data

- 555** - **Indicator that national code groups follow.**
- 110ff** - **Wind speed at 10 meters.** The group 11026 indicates a speed of 26 knots.

- 220ff - **Wind speed at 20 meters.** The group 22028 indicates a speed of 28 knots.
  
- 3GGgg - **Time at which the peak wind occurred since the last observation.** The group 31144 indicates the peak wind occurred at 1144 UTC.
  
- 4ddfff - **Direction and speed of the peak wind speed.** The group 415041 indicates a wind direction of 150 degrees and a wind speed of 41 knots.
  
- 6GGmm - **End time in hours and minutes of the latest 10-minute continuous wind measurement.** The group 61159 indicates a time of 1159 UTC.
  
- ddfff  
ddfff  
ddfff  
ddfff  
ddfff  
ddfff - **These six groups report the wind direction and speed for successively older 10-minute average wind direction and speed.** The group 082027 indicates the first oldest 10-minute average wind direction of 082° and a speed of 27 knots. The group 082025 is the sixth oldest continuous 10-minute average wind direction of 082° and an average speed of 25 knots.
  
- TIDE1hhh - **Height of tide above the Mean Lower Low Water (MLLW).** Some sites report tidal information in this format. The group TIDE1157 indicates a height of 1.57 feet above mean lower low water.